

Ephemeris for Physical Observations of the Moon for the First Half of 1899. By A. C. D. Crommelin.

Greenwich Noon.		Selenographical Colong. of the Sun.	Lat.	Geocentric Libration Sel. Long. of the Earth.	Lat.	Combined Amount.	Direc- tion.
1899.							
Jan.	1	143°21	+ 0°06	−4°58	+ 5°32	7°02	40°7
	2	155°36	0°09	5°71	6°09	8°34	43°2
	3	167°50	0°11	6°63	6°61	9°35	45°1
	4	179°65	0°14	7°30	6°82	10°00	47°0
	5	191°81	0°17	7°63	6°70	10°15	48°7
	6	203°97	0°20	7°59	6°24	9°79	50°6
	7	216°14	0°23	7°12	5°41	8°97	52°8
	8	228°32	0°26	6°22	4°23	7°53	55°8
	9	240°51	0°29	4°91	2°76	5°65	60°7
	10	252°69	0°32	3°24	+ 1°06	3°40	71°9
	11	264°89	0°35	−1°33	−0°74	1°52	119°1
	12	277°08	0°38	+ 0°71	2°50	2°60	195°9
	13	289°28	+ 0°41	2°70	4°07	4°88	213°5
	14	301°47	0°44	4°48	5°36	6°97	219°9
	15	315°65	0°47	5°96	6°23	8°60	223°7
	16	325°83	0°49	7°01	6°70	9°67	226°3
	17	338°00	0°52	7°57	6°78	10°14	228°2
	18	350°16	0°55	7°74	6°48	10°06	230°1
	19	2°32	0°57	7°47	5°86	9°49	231°9
	20	14°47	0°60	6°82	4°97	8°46	233°9
	21	26°62	0°62	5°89	3°87	7°07	236°7
	22	38°76	0°65	4°74	2°62	5°40	241°1
	23	50°90	0°67	3°44	−1°26	3°65	249°9
	24	63°04	0°69	2°06	+ 0°13	2°06	273°6
	25	75°17	+ 0°71	+ 0°64	1°52	1°64	337°2
	26	87°31	0°74	−0°75	2°84	2°93	14°8
	27	99°44	0°76	2°10	4°03	4°55	27°5
	28	111°58	0°78	3°35	5°06	6°07	33°5
	29	123°71	0°80	4°48	5°88	7°41	37°3
	30	135°85	0°83	5°47	6°43	8°42	40°4
	31	147°99	0°85	6°28	6°70	9°18	43°1
Feb.	1	160°14	0°88	6°88	6°65	9°56	46°0
	2	172°29	0°90	7°22	6°28	9°53	49°0
	3	184°45	+ 0°93	−7°28	+ 5°58	9°17	52°5

Dec. 1898.

Physical Observations of the Moon.

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Greenwich Noon.		Selenographical		Geocentric Libration		Combined Amount.	Direc- tion.
		Colong. of the Sun.	Lat.	Sel. Long. of the Earth.	Lat.		
1899. Feb.	4	196°62	+ 0°95	− 7°00	+ 4°55	8°33	57°0
	5	208°79	0°97	6°36	3°23	7°12	63°1
	6	220°97	+ 1°00	5°34	+ 1°68	5°61	72°5
	7	233°15	1°02	3°95	− 0°02	3°95	90°3
	8	245°35	1°04	2°25	1°75	2°86	127°9
	9	257°55	1°07	− 0°34	3°38	3°41	174°2
	10	269°75	1°09	+ 1°65	4°77	5°06	199°1
	11	281°95	1°11	3°54	5°82	6°81	211°3
	12	294°15	1°13	5°18	6°46	8°27	218°7
	13	306°34	1°15	6°43	6°66	9°26	224°0
	14	318°53	1°17	7°21	6°47	9°66	228°1
	15	330°71	1°18	7°49	5°91	9°51	231°7
	16	342°89	1°20	7°29	5°07	8°89	235°2
	17	355°06	1°21	6°67	4°01	7°80	239°0
	18	7°22	+ 1°23	5°71	2°78	6°34	244°1
	19	19°38	1°24	4°51	1°46	4°74	252°1
	20	31°54	1°26	3°17	− 0°09	3°17	268°4
	21	43°69	1°27	1°72	+ 1°28	2°15	306°7
	22	55°84	1°28	+ 0°30	2°58	2°61	353°4
	23	67°99	1°30	− 1°05	3°78	3°93	15°5
	24	80°14	1°31	2°29	4°82	5°35	25°4
	25	92°28	1°32	3°38	5°66	6°57	30°8
	26	104°42	1°33	4°30	6°24	7°55	34°6
	27	116°57	1°34	5°04	6°54	8°24	37°6
	28	128°71	1°36	5°60	6°53	8°62	40°6
March	1	140°86	1°37	5°98	6°20	8°62	44°0
	2	153°02	+ 1°38	6°17	5°54	8°27	48°1
	3	165°18	1°40	6°15	4°58	7°69	53°3
	4	177°34	1°41	− 5°90	+ 3°36	6°78	60°3
	5	189°52	1°42	− 5°40	+ 1°91	5°72	70°5
	6	201°70	1°43	4°62	+ 0°32	4°62	86°0
	7	213°89	1°45	3°55	− 1°32	3°80	110°4
	8	226°09	+ 1°46	2°20	2°90	3°65	142°8
	9	238°29	1°47	− 0°63	4°30	4°34	171°6
	10	250°50	1°48	+ 1°06	5°43	5°54	191°0
	11	262°71	1°49	2°73	6°19	6°75	203°8
	12	274°93	+ 1°49	+ 4°24	− 6°52	7°76	213°0

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Greenwich Noon.		Selenographical Colong. Lat. of the Sun.		Geocentric Libration Sel. Long. Lat. of the Earth.		Combined Amount.	Direc- tion.
1899.							
March	13	287°14	+ 1°50	+ 5°44	− 6°44	8°44	220°2
	14	299°35	1°51	6°24	5°97	8°61	226°3
	15	311°55	1°51	6°56	5°18	8°33	231°7
	16	323°75	1°51	6°43	4°13	7°65	237°3
	17	335°95	1°51	5°87	2°92	6°57	243°5
	18	348°14	1°51	4°95	1°59	5°20	252°2
	19	0°32	1°51	3°78	− 0°22	3°78	266°7
	20	12°50	+ 1°51	2°44	+ 1°13	2°68	294°8
	21	24°67	1°51	+ 1°03	2°44	2°66	337°1
	22	36°84	1°51	− 0°36	3°63	3°66	5°7
	23	49°01	1°51	1°64	4°68	4°96	19°3
	24	61°17	1°51	2°77	5°53	6°19	26°6
	25	73°33	1°51	3°69	6°14	7°18	31°0
	26	85°49	1°51	4°38	6°47	7°83	34°1
	27	97°65	1°51	4°84	6°49	8°11	36°7
	28	109°80	1°51	5°08	6°18	7°97	39°4
	29	121°96	1°51	5°12	5°52	7°56	42°9
	30	134°13	1°50	5°00	4°59	6°80	47°4
	31	146°29	1°50	4°71	3°38	5°79	54°3
April	1	158°47	+ 1°50	4°29	1°96	4°72	65°4
	2	170°65	1°50	3°70	+ 0°40	3°74	83°8
	3	182°83	1°50	2°97	− 1°19	3°21	111°8
	4	195°03	1°50	2°06	2°74	3°42	143°1
	5	207°23	1°49	− 0°99	4°13	4°25	166°5
	6	219°44	1°49	+ 0°22	5°26	5°26	182°4
	7	231°66	1°49	1°49	6°07	6°25	193°8
	8	243°89	1°48	2°74	6°49	7°07	202°9
	9	256°11	1°47	3°88	6°50	7°54	210°8
	10	268°34	1°47	4°77	6°12	7°77	217°9
	11	280°57	1°46	5°34	5°38	7°59	224°8
	12	292°79	1°45	5°53	4°37	7°02	231°7
	13	305°02	+ 1°44	5°32	3°15	6°17	239°4
	14	317°23	1°42	4°74	1°81	5°07	249°1
	15	329°45	1°41	3°84	− 0°41	3°88	263°9
	16	341°65	1°40	2°69	+ 0°98	2°85	290°0
	17	353°86	1°38	1°39	2°32	2°71	329°1
	18	6°06	1°37	+ 0°01	3°54	3°54	359°8
	19	18°25	+ 1°35	− 1°32	+ 4°61	4°79	16°0

Greenwich Noon.		Selenographical Colong. Lat. of the Sun.		Geocentric Libration Sel. Long. Lat. of the Earth.		Combined Amount.	Direc- tion.
1899. April	20	30°44	+ 1°34	− 2°56	+ 5°49	6°04	25°0
	21	42°62	1°33	3°60	6°14	7°12	30°4
	22	54°81	1°31	4°40	6°52	7°89	34°0
	23	66°99	1°30	4°91	6°59	8°24	36°7
	24	79°16	1°28	5°13	6°33	8°17	39°0
	25	91°33	+ 1°27	5°07	5°72	7°66	41°5
	26	103°50	1°26	4°76	4°80	6°77	44°8
	27	115°68	1°24	4°24	3°58	5°55	49°8
	28	127°85	1°23	3°56	2°13	4°17	59°1
	29	140°03	1°22	2°77	+ 0°54	2°83	79°0
May	30	152°22	1°20	1°90	− 1°10	2°18	120°0
	1	164°41	1°19	0°98	2°67	2°86	159°8
	2	176°61	1°17	− 0°01	4°09	4°09	179°9
	3	188°82	1°16	+ 0°96	5°25	5°35	190°4
	4	201°04	1°14	1°94	6°09	6°39	197°7
	5	213°26	1°13	2°86	6°57	7°16	203°5
	6	225°49	1°11	3°68	6°64	7°57	209°0
	7	237°73	+ 1°09	4°36	6°33	7°66	214°6
	8	249°97	1°07	4°81	5°66	7°41	220°4
	9	262°21	1°05	4°98	4°70	6°87	226°6
	10	274°45	1°03	4°87	3°50	5°99	234°3
	11	286°69	1°00	4°45	2°15	4°94	244°2
	12	298°93	0°98	3°74	− 0°72	3°81	259°1
	13	311°16	+ 0°96	2°75	+ 0°72	2°83	284°7
	14	323°39	0°94	1°60	2°09	2°63	322°5
	15	335°62	0°91	+ 0°30	3°38	3°38	354°9
	16	347°84	0°89	− 1°04	4°50	4°63	13°0
	17	0°05	0°86	2°36	5°44	5°93	23°5
	18	12°27	0°84	3°57	6°14	7°12	30°2
	19	24°47	0°82	4°58	6°59	8°04	34°8
	20	36°67	0°79	5°33	6°74	8°56	38°3
	21	48°87	0°77	5°77	6°56	8°72	41°3
	22	61°06	0°75	5°87	6°05	8°41	44°1
	23	73°25	0°73	5°62	5°19	7°64	47°3
	24	85°43	0°71	5°04	4°02	6°45	51°4
	25	97°62	+ 0°69	4°17	2°58	4°92	58°3
	26	109°80	0°66	3°08	+ 0°95	3°23	72°9
	27	121°98	+ 0°64	− 1°86	− 0°75	2°01	112°0

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Greenwich Noon.		Selenographical Colong. Lat. of the Sun.		Geocentric Libration Sel. Long. Lat. of the Earth.		Combined Amount.	Direc- tion.
1899.							
May	28	134° 17	+ 0° 62	- 0° 57	- 2° 42	2° 49	166° 8
	29	146° 37	0° 59	+ 0° 72	3° 93	4° 01	190° 4
	30	158° 57	0° 57	1° 94	5° 18	5° 54	200° 6
	31	170° 78	0° 55	3° 02	6° 10	6° 83	206° 3
June	1	183° 00	0° 53	3° 94	6° 64	7° 70	210° 7
	2	195° 23	0° 50	4° 67	6° 78	8° 20	214° 6
	3	207° 46	0° 47	5° 18	- 6° 53	8° 36	218° 4
	4	219° 70	0° 45	5° 45	5° 93	8° 06	222° 6
	5	231° 94	0° 42	5° 47	5° 02	7° 44	227° 5
	6	244° 19	+ 0° 40	5° 24	3° 87	6° 50	233° 6
	7	256° 44	0° 37	4° 76	2° 54	5° 38	241° 9
	8	268° 69	0° 34	4° 05	- 1° 12	4° 21	254° 5
	9	280° 93	0° 31	3° 13	+ 0° 34	3° 16	276° 2
	10	293° 18	0° 28	2° 03	1° 76	2° 68	310° 9
	11	305° 43	0° 25	+ 0° 79	3° 09	3° 18	345° 6
	12	317° 67	0° 22	- 0° 52	4° 28	4° 32	7° 0
	13	329° 91	0° 20	1° 87	5° 27	5° 59	19° 5
	14	342° 14	0° 17	3° 18	6° 05	6° 84	27° 7
	15	354° 37	0° 14	4° 38	6° 56	7° 87	33° 7
	16	6° 59	0° 11	5° 41	6° 80	8° 70	38° 5
	17	18° 81	0° 09	6° 18	6° 73	9° 15	42° 6
	18	31° 02	0° 06	6° 65	6° 33	9° 18	46° 4
	19	43° 23	0° 03	6° 74	5° 60	8° 76	50° 3
	20	55° 43	+ 0° 01	6° 46	4° 54	7° 88	54° 9
	21	67° 62	- 0° 02	5° 78	3° 19	6° 59	61° 1
	22	79° 82	0° 04	4° 71	+ 1° 61	4° 99	71° 1
	23	92° 00	0° 07	3° 34	- 0° 12	3° 34	92° 1
	24	104° 19	0° 09	1° 74	1° 86	2° 55	136° 9
	25	116° 38	0° 11	- 0° 02	3° 49	3° 49	179° 6
	26	128° 57	0° 14	+ 1° 69	4° 87	5° 16	199° 1
	27	140° 77	0° 16	3° 25	5° 92	6° 75	208° 8
	28	152° 98	0° 19	4° 60	6° 57	8° 02	215° 0
	29	165° 19	0° 22	5° 64	6° 81	8° 85	219° 6
	30	177° 41	0° 24	6° 34	6° 63	9° 15	223° 7
July	1	189° 64	- 0° 27	+ 6° 69	- 6° 09	9° 03	227° 7

This ephemeris has been computed in the same manner and with the same constants as those in recent years. The inclination of the Moon's equator to the ecliptic is assumed to be 1° 52' 3", the

value adopted by the *Connaissance des Temps*; that given by the *Nautical Almanac* is $1^{\circ}.536$.

The principal term of the physical libration in longitude has been applied as before, the expression for it being $-0^{\circ}.037 \times \text{Sun's mean anomaly}$.

The colongitude of the Sun is 90° (or 450°) *minus* his selenographical longitude. It also is the selenographical longitude of the morning terminator reckoned eastward from the mean centre of the disc. Hence its value is approximately 270° , 0° , 90° , 180° at new Moon, first quarter, full Moon, last quarter respectively. The longitude of the evening terminator is of course 180° greater or less than that of the morning one.

When the geocentric libration in longitude is positive, the region brought into view is on the west limb; when negative, on the east.

When the geocentric libration in latitude is positive, the region brought into view is at the Moon's north pole; when negative, at the south.

The column "Combined Amount" gives the distance between the apparent and mean centres of the disc, and the column "Direction" gives the position angle of the apparent centre from the mean centre, or, which is the same thing, the position angle of the region which is most carried into view by libration. The angles are reckoned eastward from the northern extremity of the Moon's axis.

The terms "East" and "West" are used throughout with reference to our sky, and not as they would appear to an observer on the Moon.

Attention may be drawn to the unusually favourable conditions for studying the regions adjacent to the north-east and south-west limbs, which will occur on January 5 and 17 respectively. February 1, 14, 28 are also favourable, but to a less extent.

It has been suggested that this ephemeris should be made for Greenwich midnight instead of noon, and I propose in future to adopt this course, which will obviously be more convenient for European observers. A similar course in the Planetary Ephemerides would be desirable, but it would add considerably to the labour of computation, as the *Nautical Almanac* gives the places of the planets for noon and not for midnight.

Benvenue, Ulundi Road, Blackheath, S.E.:
1898 December 8.